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(54) Title: FUEL COMPOSITION FOR THE OPERATION OF INTERNAL-COMBUSTION ENGINES AS HYBRID ENGINES, PROCESS TO PRODUCE SAID COMPOSITIONS AND METHOD TO APPLY THE SAME

(57) Abstract

Water containing fuel composition for the operation of non-gaseous, internal-combustion engines as hybrid engines, containing 60-90 mass%, preferably 45-80 mass% fuel prescribed for engine, 40-10 mass% - in a given case distilled-water, 0,5-5,0 mass%, preferably 5-15 mass% total emulsifier and other additives if required.

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Fuel composition for the operation of internal-combustion engines as hybrid engines, process to produce said compositions and method to apply the same

Technical Field

The invention relates to fuel compositions for the operation of non-gaseous internal-combustion engines as hybrid engines, process to produce said compositions and method to apply them as fuel.

Background Art

It is known both from literature and practice that the performance of internal combustion engines can be increased by adding water to the fuel applied. Therefore there have been various attempts for using fuel containing water. For example during the second world war - in order to increase the performance - such a technical resolution was applied for the Focker type fighters where water was injected into the cylinders of the engine by a separate injector after the electric ignition. In this manner actually a 10-15 % preformance increasing increase could have bean reached, proving the advantage of the solution. However, as a disadvantage, the engines could have been operated only after structual modifying plus installation and exact adjustment of an appropriate injector. In case of aircrafts further considerable disadvantage was that the mounting of the injector and separate water tank resulted undesirable increasing in weight.

From the specification of EP-177 484 A1 a method has been known according to a fuel-water dispersion has been injected into the combustion chamber of the engine. This process requires such basical technical modification - i. e. settlement of heat exchanger, collector, etc.- so that the advantages supposed because of the presence of water beside fuel can not be utilitised duly.

A basically similar procedure for the use of fuel-water dispersion - with improved technical details - can be learnt from EP-142 580 A1. However, the disadvantage of the solution is even in this case the necessity of the modification of the engine and its technical environment for the operation.

EP- 0 311 877 A2 teaches a similar conception where the described cylinder head allows the access of the water into the combustion chamber in steam form. The disadvantage of this technical solution is the necessary use of complementary equipments.

In addition the application of fuels with water content can be learnt from US P.S. No. 5 156 114, re-issued No. re. 35,237. In this case the disadvantages are that air reached in hydrogen is required to operate the engine, 28-30 000 Voltage should be supplied to the operation, engine modification is necessary and finally the method is suitable for stabile located engines only, so that it is not appropriate for the vehicles running on public roads.

With respect to the aboves, the aim of the invention is ensure fuel composition containing water, for non-gaseous, internal-combustion engines, without the necessity of engine modification, and to make the economical operation of the fuel possible so that a part of the thermal energy from wastes arising during the combustion transmutes into mechanic energy, while the environmental pollution considerably decreases.

Disclosure of Invention

On basis of the aforesaid reasons the problem to be solved by the invention was to feed water together with fuel into combustion chamber of the engine in a quantity ensuring the operation of the engine as steam engine as well, the said fuel mixture can be injected into the combustion chamber by the technical equipment - applied for vaporizing - available in the hybrid engine. To

achieve the aim of the invention a new fuel composition and process to produce the same further method to apply fuel compositions mentioned have been worked out.

Surprisingly it has been found that this aim could be achieved if - instead of the fuel mixture had been made in dispersion form till now- a stable emulsion containing water would be prepared according to the present invention and its access into the combustion chamber of the engine. Thus the invention is based on the recognition that that petrol having various octane numbers or diesel-oil mixed with adequate quantity of water and emusifier agents and other additives if required are able to form a stable emulsion, prepared by the process of the invention, and the stable emulsion obtained is suitable for the operation of internal-combustion engines.

When preparing emulsions a person skilled in the art can choose emulsifiers and additives by learning for example from the following technical or patent literature: Kovács-Halmos: Szerveskémia, Budapest, 1972.; Erdey-Gruz: Fizikai kémia, Budapest, 1972.; Végh-Szász: Gyógyszerészi kémia, Tankönyvkiadó, Budapest, 1972., pp. 35-79. ; Kedvessy: Gyógyszertechnológia, Medicina, Budapest, 1971., pp 320-352; Mázor L., Analitikai Zsebkönyv, Műszaki Kiadó, 1971., pp. 79-92; Brzekner Gy., Szerveskémia, Tankönyvkiadó, Budapest, 1973., pp. 67-331; and US PS 4 729 769, US PS 4 594 111, US PS 4 100 097, US PS 5 021 183, US PS 4 438 025, US PS 5 443 757, US PS 3 886 087, US PS 4 210 700, US PS 4 917 883.

Description of the preferred embodiements

The composition according to the present invention is characterised in that containing 60-90 mass%, preferably 45-80 mass% fuel prescribed for the engine, 40-10 mass% - in a given case distilled - water, 0,5-5,0 mass%, pref-

erably 5-15 mass% total-emulsifier and other additives if required. In the preferable cases substantially the ratio of the characteristic hydrocarbons contained by petrol is changed so that it is encreased for the required value in base speed and in the reduced torque showing range. Therefore the composition containes in an amount of about 10 mass% C 4-7 alcohols and/or carbonhydrogenes having lower boiling point. In case of diesel oil the situation is similar to bring the cetane index in the original position (above 48). For this purpose n-hexane and/or cyclohexane and/or n-heptane and/or n-pentane is added to the fuel in an amount of max. 10 mass%. Also the fuel (petrol) in this preferable cases basically is previously treated in the above manner. As emulsifier can be used - amongst numerous well-known emulsifiers - anion active emulsifiers in a given amount, like alkali- and alkali earth metal soaps; non-ionic emulsifiers such as fatty alcohols, esters or polybasic fatty alcohols formed with fatty acids, fatty acid esters of polyethylene glycol, sorbite fatty acid esters of polyethylene glycol or the combination of them. Preferably at least two emulsifiers are simulteanously applied in the composition according to the invention. Further advantagous representants of the emulsifiers are those of made from fatty acids of natural coconut oil, coconut fatty acid esters, polyethylene derivates of coconut fatty acid esters and coconut fatty acid amides, too. Glycerine can be used for example as an additive in an amount of 0,02-0,5 mass%. Glycerine is favourable because its combustion products are neutral, moreover it hinders the deposition of the combustion products on the non-friction parts. The composition may contain different quasi-emulgents as additive, in a similar amount as glycerine, for the sake of keeping the mixture in emulsion.

The process of the invention is characterised in that the emulsifiers are added - in accordance with their attributes - to the polar or nonpolar medium. In

case of petrol or diesel oil compositions, the required amount of water is added to the pre-treated petrol or oil as described above, and following the emulsifier(s) having higher HLB values, than the emulsifier(s) having the lower HLB values are added to the system containing the components and maintaining intensive mixing. In this way an opal emulsion is obtained. Continuing mixing quasi-emulgents and stabilising agent are added to the mixture as well. As a result a clear or mild opalic emulsion is obtained having stability properties considering to time and heat which are properly for the purpose of the invention.

The composition according to the present invention can be prepared on a manifacturer site and can be delivered to the place of selling or use, however, it is not inevitably necessary to prepare it in advance as there is no particular demand for tools or expertise for the process, therefore it can be favourably carried out on or nearby the site of application.

A further subject of the invention is the application of the composition according to the invention for internal-combustion engines, which is characterised by injecting the composition as defined above into the combustion chamber of the engine.

For better understanding of the invention the operational mechanism of the composition is made clear below, showing the principle of the operation with the shematical operation of a four-stroke petrol motor.

During the first cycle the piston is moving from the top dead centre to the bottom d.c., the mixture of the emulsion and air is flowing into the cylinder through the open inlet valve. In the second stroke - with closed inlet valves - the piston is moving from the bottom d. c. to the top d. c., while the mixture in it being compressed. In consequence of the compression the temperature exceeds

the critical point of the water, so that the water is getting from liquid state to steam or superheated steam. Due to the state change a pressure gradient occurs at the mentioned critical point , so that the compressing thermal pressure will be higher than it could be expected normally according to the structural attitude of the given engine. At the end of the compression stroke the ignition occurs and the combustible parts of the emulsion burn, due to the presence of the superheated steam the pressure taking effect on the piston is higher than in case of fuel not consisting water. In the third stroke the pressure force the piston towards the bottom d. c., and the combustion products and the expaneded steam leave the combustion chamber through the open exhaust valve.

The figurative wording of the procedure is that the steam chamber and the cylinder of a steam engine boiler have been integrated into an operating petrol engine. It is conceivable that thermal efficiency of the engine improves with adding water.

The deviation of the principle of operation at diesel engines is that in this case the emulsion of diesel-oil and water is vaporised into the compressed air. At this type of engine only a so-called „steam engine effect" appears due to water adding, therefore the increasing of the efficiency is lower than in case of Otto-motors.

The invention is illustred by the following examples, without limiting the scope of invention to the examplified matter.

Example 1

In this case we describe the experiences of the preparation and test running of fuel emulsion suitable for a petrol, four-stroke engine with injector and catalyzer. The test vehicle was a Mazda 626 type car with 2,2 litre injector and engine with 12 valves, run 258,000 kms. The fuel emulsion according to

the invention was made as follows: 750 g 91 octane unleaded petrol, 1 g polyethylene glycol derivatives of natural coconut fatty acid esters, 1 g coconut fatty acid amides, 5 g glycerin as stabilizer and 240 g tap water with 23 nk hardness. The listed emulsifiers were poured together and were feeded to the water in give quantity during continuous stirring. The prepared mixture was filled into the 750 g 91 octane petrol so as to get emulsion. We continued the homogenization with electric mixer for 10 minutes. The emulsion was poured into the empty tank of the car with previously discharge fuel system. After starting we increased the speed of the car normally to 80 km/h and we were driving with approximately constant speed until the fuel ran out. The accelerating ability of the car during the experiment was as usual earlier, and we did not learn any running irregularity or misfire. The performed 15,5 km distance is 2,5 kms more than the distance achieved furing the trial with exactly the same way and direction but with the prescribed 91 octane petrol. The colour of the spark plugs did not show alteration.

In the second phase of the experiment we examined the consequenses of the change-overs from fuel emulsion according to the invention to normal fuel and from normal fuel to fuel emulsion. The change-overs were carried out by simple filling up. No perceptible change in the engine operation could have been observed in either case.

The emulsion described above is perative without increasing the quantity of the emulsifiers and the stabilizer, until 60-40 mass% petrol-water emulsion, repsectively, and with adding further additives.

Example 2

In this case we prepared fuel emulsion for the engine with 1,5 litre cylinder capacity of a diesel VW microbus, without turbocharger and with 48,000 km

run. We mixed 3 g coconut oil fatty acid exter, 1 g polyethylene glycol derivatives of coconut oil fatty acid esters, 1 g sodiumlauril sulfate and 5 g glycerin in 240 g distilled water. 10 g cyclohexane was filled into 740 g diesel-oil. The mixture containing water was poured into the blend containing diesel-oil during intensive stirring. We continued the mixing for 10 minutes. The experiment according to the first test was repeated with the obtained mixture. The reached distance was 17 kms, while we could have run only 16 kms using pure diesel oil. Operating anomalies did not shown up during the application of the fuel emulsion and at the change-overs from normal fuel and back.

The emulsion described above is operative without increasing the quantity of the emulsifiers and the stabilizer, until 60-40 mass% diesel oil respectively, and with adding further additives.

<u>The main advantages of the method according to the invention</u>

A) The quantity of the traditional fuel can be decreased appl. 40% using the produced emulsion, while the performance remains nearly unchanged. Bacause of the colling effect the virtual octane number of petrol considerably increases, therefor a fuel prepared from a single type of petrol (octane number is 91) can be properly used instead of petrols having higher octane number.

B) According to the described method the operating cost of the non-gaseous engines decreases appr. 30%.

C) Above all we use components with natural basic material, the combustion products of which are innocuous for the environment. They influence on the combustion of the fuel so that the quantity of the arising component containing the environment reduces. The quantity decrease of the environment damaging combustion products of the petrol or diesel-oil is nearly in propor-

tion to the quantity of the added water, since the fuel is substituted with the water injected into the combustion changer. The carbon monoxide and carbon dioxide content of the combustion products considerably decreases by this method.

D) The engines to be operated by the process according to the invention do not require technical modification.

. What is claimed is:

1. Water containing fuel composition for the operation of non-gaseous, internal-combustion engines as hybrid engines, characterised in that containing 60-90 mass%, preferably 45-80 mass% fuel prescribed for engine, 40-10 mass% - in a given case distilled-water, 0,5-5,0 mass%, preferably 5-15 mass % total emulsifier and other additives if required.

2. Compositions according to claim 1 characterised in that it contains one or more emulsifiers from the group prepared from of fatty acids of natural coconut oil, coconut fatty acide esters, polyethylene derivates of coconut fatty acid esters and coconut fatty acid amides.

3. Compositions according to claim 1 or 2 characterised in that containig stabiliser agent in an amount of 0,02-1,0 mass %.

4. Compositions according to claim 3 characterised in that containing glycerine.

5. Compositions according tclaims 1 or 2 characterised in that containing quasi-emulgents as additive, in an amount of 0,02-0,5 mass%.

6. A composition according to claims 1 or 2 characterised in that containing max. 10 mass % n-hexane and/or cyclohexane and/or lower boiling point carbonhydrogene such as n-heptane and/or n-pentane and/or derivates thereof.

7. Process to produce compositions according to the previous claims characterised in that components according to claims 1-6 are applied in the given amount and the components are added into polar or nonpolar medium depending on their properties, so that water and - preferably pre-treated - petrol are mixed and first the emulsifiers having lower HLB value than emulsifiers having higher HLB value are admixed to the mixture, while maintaining stirring, following quasi-emulgents and stabilising agents and in a given case other additives are given into the system.

8. Use of compositions according to any of claims 1-6, characterised in that any of the compositions according to claims 1-6 is fed into the combustion chamber of the engine.

9. Use according to claim 8 characterised in that the composition is fed into the combustion chamber of the engine and applied as fuel by means being originally in the engine.

AMENDED CLAIMS

[received by the International Bureau on 25 November 1997 (25.11.97); original claims 1 and 7 amended; remaining claims unchanged (2 pages)]

1. Water containing fuel composition for the operation of non-gaseous, internal-combustion engines as hybrid engines, characterised in that containing 60-90 mass%, preferably 45-80 mass% fuel prescribed for engine, 40-10 mass% - in a given case distilled - water, 0,5-5,0 mass%, preferably 5-15 mass % total emulsifier and other additives if required, the components being present in the form of molecular-dispers or colloid-dispers system.

2. Compositions according to claim 1 characterised in that it contains one or more emulsifiers from the group prepared from of fatty acids of natural coconut oil, coconut fatty acide esters, polyethylene derivates of coconut fatty acid esters and coconut fatty acid amides.

3. Compositions according to claim 1 or 2 characterised in that containig stabiliser agent in an amount of 0,02-1,0 mass %.

4. Compositions according to claim 3 characterised in that containing glycerine.

5. Compositions according tclaims 1 or 2 characterised in that containing quasi-emulgents as additive, in an amount of 0,02-0,5 mass%.

6. A composition according to claims 1 or 2 characterised in that containing max. 10 mass % n-hexane and/or cyclohexane and/or lower boiling point carbonhydrogene such as n-heptane and/or n-pentane and/or derivates thereof.

7. Process to produce compositions according to the previous claims characterised in that components according to claims 1-6 are applied in the given amount and the components are added into polar or nonpolar medium depending on their properties, so that water and - preferably pre-treated - petrol are mixed and first the emulsifiers having lower HLB value than emulsifiers having higher HLB value are admixed to the mixture, while maintaining stirring, following quasi-emulgents and stabilising agents and in a given case other additives are given into the system, forming molecular-dispers or colloid -dispers system.

8. Use of compositions according to any of claims 1-6, characterised in that any of the compositions according to claims 1-6 is fed into the combustion chamber of the engine.

9. Use according to claim 8 characterised in that the composition is fed into the combustion chamber of the engine and applied as fuel by means being originally in the engine.

INTERNATIONAL SEARCH REPORT

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A. CLASSIFICATION OF SUBJECT MATTER
IPC 6. C10L1/32

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 C10L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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X	US 4 158 551 A (FEUERMAN ARNOLD I) 19 June 1979 see claim 1 see column 2, line 25 - line 29 ---	1,2,8,9
X	EP 0 475 620 A (EXXON RESEARCH ENGINEERING CO) 18 March 1992 see claim 1 ---	1
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X	WO 95 27021 A (GUNNERMAN RUDOLF W) 12 October 1995 see claims 1,9,13,14,25,26 --- -/--	1,8

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

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